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TURKEY FERTILITY

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TURKEY FERTILITY... REPRODUCTION-ARTIFICIA

A SUCCESSFUL TURKEY BREEDING PROGRAM . . .

depends on a chain of practices that starts with adult turkeys and ends with a high yield of vigorous, thrifty, healthy poults. Some of the important points in a successful breeding program are:

Good selection of strains for breeding
Adequate natural mating or up-to-date insemination procedures
Disease-free or vaccinated adult breeder stock
Adequate breeder ration
Suitable housing, light, and temperature
High egg production
Good shell and interior egg quality
Ideal conditions for holding eggs
Well-equipped hatchery with modern, well-regulated incubators
Careful sanitation program
Proper brooder preparation

All of these links in the turkey production chain have been studied and tested by University of California poultry specialists. The latest results of their studies are described and explained in this circular.

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The Basis of Fertility

Meaning of fertility

The dictionary defines fertility as "the ability to produce offspring." This is the commonly used definition for mammalian reproduction. With reference to birds, however, it is convenient and useful to focus attention on these separate components of the fertility complex:

Egg production
Semen production
Mating and/or insemination
Transport and viability (survival of sperm in the oviduct)
Fertilization
Viability of the embryos: preovipositial and preincubation; during early incubation; during late incubation and the hatching stage

In domestic birds this complex is often called "reproductive performance," and the term "fertility" refers only to the percentage of eggs that are fertile. Since most hatcheries include early dead embryos among the eggs reported as infertile, however, fertility figures require careful interpretation. For instance, research reports of 90 per cent fertility may be equivalent to 75 to 80 per cent as reported by commercial hatcheries. All steps in the reproductive process are vital in a production program, though some may be more important to breeders and others to hatchery operators. All have been considered carefully in the preparation of this publication.

Physiology of turkey reproduction

Before examining the components of the turkey fertility complex in detail, we shall describe briefly what happens in the normal process of fertilization.

The testes start producing sperm when the toms are about 150–250 days old. These sperm, after going through several stages that take about a month to complete, finally leave the testes and travel down ducts termed the vasa deferentia. The sperm mature in these ducts and are stored there for only a short time. The posterior parts of the vasa deferentia are thickened by increased musculature, and they are expanded into "bulbous ducts" just before they terminate in narrow papillae, which pour semen onto the surface of the phallus. This organ contains erectile tissue, but the process of erection differs from the mammalian: the tissue becomes engorged with lymph instead of blood.

During copulation the duct walls contract, ejecting semen through the papillae onto the surface of the phallus, which has extended beyond the lips of the cloaca. The female extrudes the everted vagina beyond the lips of the cloaca; the male then presses his phallus against the everted tip and deposits semen on it. The female immediately withdraws the vagina, carrying the semen far inward. Sperm must now penetrate the junction of the uterus and vagina by their own motility, but once this barrier is passed they are swept rapidly upward to the anterior end of the oviduct (the infundibulum) where they "lie in wait" for freshly ovulated yolks and fertilize them as they pass by.

Egg production

Without proper breeding, feeding, management, and disease control, adequate numbers of eggs (fertile or otherwise) will not be produced. These egg-production factors are discussed elsewhere (pages 7–12).

In egg production, turkeys and chickens differ from some other species of birds. With most wild birds (and the

domestic pigeon), eggs are rarely laid until after a period of courtship by the male. In turkeys and chickens, however, neither matings nor courtship are required for egg production.

Semen production

A few toms may produce traces of semen at five months of age, but first production of amounts sufficient for satisfactory fertilization occurs somewhat later. The majority of a flock is not usually in adequate semen production until about eight months of age. Since some birds pause for varying periods, there will be at least a few nonproducers in the flock at all times. Semen production declines as summer months approach and tends to decrease rapidly with the onset of hot summer weather. Once ended, production is not resumed until the following year, the exact time varying with the location and, if the birds are not housed, with the weather. A few birds that do not go out of production during the summer may continue to produce semen throughout the year.

Amounts of semen produced by toms vary greatly during productive periods. Work with chickens has indicated that an amount of semen containing at least 100 million sperm is necessary for optimum fertility. Available evidence suggests that this number may be adequate for turkeys also, but a somewhat larger amount is ordinarily used in artificial insemination. Average turkey semen contains about 11 billion sperm per milliliter, but the concentration may vary from a very few to about 20 billion per milliliter. Semen with satisfactory sperm numbers characteristically has a thick, creamy appearance; if few sperm are present, it is thin and watery.

A flock may contain some nonproducing males at all times. These are worse than useless in a breeding flock, since they cannot mate and by their aggressive behavior they prevent other males from mating.

Mating

In turkeys the mating act is initiated by the hen. This is an important consideration, since much infertility in healthy flocks is the result of inadequate mating. Hens are most uniformly receptive to mating shortly before they begin to lay, and the pre-lay mating is thus especially important for establishing a high level of fertility. This emphasizes the importance of having mature males in the flock for several weeks before the start of lay.

The vaginas of immature hens are closed (occluded) by a membrane, which usually opens spontaneously sometime before lay begins. In some hens, however, the membrane is ruptured only by passage of the first egg. Such hens cannot be fertilized by natural mating before the start of lay. However, if the hen is nearly ready to lay, this membrane will be thin and may be readily punctured by an artificial inseminator.

If fertilization is delayed until after egg production starts (from failure of opportunity to mate, closed oviduct, or any other reason), establishment of fertility is made more difficult by decreased and intermittent receptivity of the hens.

The mating behavior of turkeys follows a definite sequence:

1. The hen approaches the tom.
2. The tom struts.
3. The hen squats.
4. The male mounts, orients himself toward the head, grips the hen's wings with his own, and treads.
5. The hen elevates her tail and everts her oviduct.
6. The male copulates.

If mating proceeds as far as step 5, the hen becomes unresponsive and will not mate again for a period of 1 to 30 days. Thus, if failures are frequent, individual hens may not be successfully mated for long periods, and maintenance of a high level of fertility in a flock may become difficult or impossible.

Important factors in mating efficiency

include male performance (an individual characteristic), adequate semen production, length of the response cycle of the hen, absence of males that interfere with successful matings, and an environment conducive to successful mating.

Sperm transport and viability in the oviduct

Knowledge of the physiology of avian sperm is fragmentary at best, and direct investigations of this subject with the turkey have been almost totally neglected. Most of the statements in this section are derived from experimental results with chickens and must be considered as only tentative for turkeys.

There may be wide variations in the quality of sperm from different males, due to genetic or physiological factors or to the health of the bird, and resulting in variations in fertilizing capacity. Laboratory tests for quality of chicken semen, based on microscopic examination and metabolic tests, have not yet been successfully applied to turkey semen. Subnormal sperm may fail to reach the infundibulum and thus produce no fertility, or else few fertile eggs may be produced and for a short time only.

The principal barrier to subnormal sperm appears to be the uterovaginal junction, and only vigorous, normal sperm get through. Above the junction the sperm do not depend on their motility to travel; they are carried rapidly upward by an as yet poorly understood action of the oviduct. Even dead sperm, introduced directly into the uterus, have been found in the infundibulum 15 minutes later.

Poor fertility from subnormal semen may thus result because few sperm pass the uterovaginal junction, or because those that do have reduced viability in the infundibulum, or both. Poor fertility, even with good semen, may also result from abnormalities of the oviduct physiology which are also incompletely understood (see below), but, in some instances at least, the abnormality may reside in the uterovaginal junction. Some birds that failed to produce any fertile eggs after ordinary artificial insemination did produce them after sperm were introduced directly into the upper region of the oviduct by surgical methods. This experimental technique is not suitable for field use, however, because once the oviduct is punctured, hens often stop laying.

Fertilization

Fertilization presumably occurs in the uppermost part of the oviduct. Sperm remain there, fertilizing each yolk very soon after ovulation. Once albumen is secreted around the yolk, it forms a barrier that the sperm cannot penetrate.

Eggs laid on the day of first mating or first insemination are never fertile; eggs laid the next day are rarely fertile unless the insemination is done early in the morning; eggs laid the second and subsequent days should be fertile. After adequate matings, or inseminations, nearly all eggs produced by the flock should be fertile for a period that averages about three weeks in early and midseason. The percentage of fertile eggs produced by the flock then declines unless the hens are remated or reinseminated.

The three-week fertile period represents an average of wide variations; depending on the individual hen, fertility may last only a day or two, or it may persist for as long as seven weeks or more. Thereafter fertility is rather abruptly terminated. Inherited differences in ability to maintain sperm viability account for some of the variations of individual hens, and age accounts for some others; sperm have a shorter life in old hens' oviducts than in those of young hens.

Certain diseases and almost anything else that impairs the hen's health and vigor may limit the life span of sperm in the oviduct. High environmental temper-

ature may also be responsible, and therefore summer matings or inseminations must be more frequent to maintain satisfactory fertility. If too few sperm are introduced, or if too few reach the infundibulum, the duration of fertility is more severely affected than is the initial level.

Embryo viability

Embryo survival is usually closely related to the level of fertility. A number of associated factors are involved in this relationship. For instance, embryos fertilized by sperm that have remained for some time in the oviduct are less capable of survival. Even embryo age at death is inversely related to sperm age. Therefore, a new mating or insemination is often followed not only by an increased number of fertile eggs, but also by fewer early dead embryos. The diagnosis of embryo failures is explained in detail on pages 13–17.

Good Breeder Management

Selection of strains

Sound decisions regarding management must be made on the basis of the known characteristics of the strain. Since no two strains are exactly alike, they will not respond equally to the same changes in environment at the same age and the same season. The males of some strains mature earlier than those of others, produce larger volumes of semen with higher concentrations of sperm, and are continuously fertile over longer periods of time. These differences are inherited, which means that these traits can be improved by selection. Heritability (the percentage of the total variation that is caused by inheritance rather than environment) is medium to high for many reproductive traits in turkeys. Selection of the best individuals is an effective way of improving such traits.

Selection for some traits is effective if the best individuals are used for breeding. This applies to body weight, conformation, and freedom from deformities. To improve reproductive traits, it is advisable to "pedigree breed" or to identify the parents so that progeny can be selected on the basis of the parents' performance. Such a program requires at least 15 males, each mated in a separate pen to 10 to 15 hens. With these numbers, the progeny of a few males and of many hens may be entirely discarded without immediate danger of excessive inbreeding. The minimum program would require identification of the eggs of each pen, in which case only the sire would be known. Trapnesting and the marking of each egg would serve to identify both parents and should make selection more effective for all traits desired, especially selection for improved reproduction. In order to benefit from any improvement made, it is of course necessary to use part of the progeny to provide the mass mated stock used for the production of commercial hatching eggs. The further use of special lines or strains as such, or for crossing, is beyond the scope of this publication.

The foregoing program could also aid in preventing deterioration in fertility when selecting for extremely heavy body weight or extreme width of breast. Unless the fertility aspect is considered, such selection frequently results in lower fertility and hatchability. Attention should thus be given to reproduction in selecting for change in weight or conformation.

Preliminary analyses indicate that there is little relation between body weight and semen production as measured by volume. Two Broad Breasted Bronze strains at Davis that differed in egg production also differed in semen production. In these cases, the heavier strain was slightly superior in both respects.

There is much evidence that the hen has an important influence on fertility. Some of this evidence (such as variation in the duration of fertility) has been attributed to differences in survival of sperm in the oviduct. In general, better fertility is obtained from Broad Breasted Bronze males mated to Beltsville Small White hens (83 per cent) than from the reciprocal matings (68 per cent) according to S. J. Marsden and M. W. Olsen (U. S. Department of Agriculture).

Since strains now available differ in reproductive performance, breeders should furnish hatchery flock owners instructions about their effective use. Breeders should in particular be able to provide information about age of maturity and any characteristics that should be considered in the management of the birds.

Environmental control

Timing and lighting. With most turkey strains now available, it is advisable to permit the birds to reach a minimum age of 7 to 7½ months before bringing them into production. With many strains, more dependable results would be obtained from slightly older birds.

Light is an important factor in controlling reproduction. When days are short or when natural light is drastically reduced (for example, by fog), artificial light can be used to bring hens into egg production. This can be done in two different ways: (1) by lengthening the day to 14 hours, or (2) by breaking the night with about one hour of light, such as from 9:00 to 10:00 P.M. The birds should receive a light intensity of about 2 foot-candles. This amount of light can be provided by 100- to 150-watt lights placed 7 to 8 feet above the birds and spaced about 20 feet apart. All-night lights are not recommended, since they cause more thin-shelled eggs to be laid and egg production tends to decrease severely after the first two months of this practice.

Standard good practice is to mate the birds about a month before eggs are wanted. Hens should never be brought into egg production within a week of the time the males are put with them. Therefore, hens should not be overlighted to bring them in fast; underlighting, by providing, for example, 12 hours of light the first week the birds are lighted, might be better.

Evidence shows that males respond to light in much the same way as hens. They probably respond more slowly than hens, however, and therefore may be lighted two or three weeks earlier. Also, males may molt and become sterile as a result of excessive lighting, according to Olsen and Marsden.

To obtain dependable egg production from pullets that will begin producing in the summer, it is advisable to subject the pullets to three or four weeks of shorter days or to decreased light before they start laying. This can be done by keeping them in a darkened house to reduce the day to 9 or 10 hours. Experiments conducted by Professor J. A. Harper of Oregon State College show that better results can be obtained from birds given three or more weeks on a 9-hour day than from birds on a short day for only one or two weeks and then given a longer day with artificial lighting.

While control of light helps obtain satisfactory out-of-season reproduction, the eventual feasibility of obtaining adequate out-of-season production depends on further advances in breeding, combined with control of the environment.

Housing and feeding equipment. Excessively high or low temperatures tend to reduce semen production. Raising temperatures to about 50° F before the breeding season apparently improved fertility at Pullman, Washington, when freezing temperatures were experienced during a cold winter. At Davis, temperatures over 90° F tended to reduce semen production.

Since stormy weather or anything that makes the birds uncomfortable may reduce fertility, some protection for the birds may be needed. Plenty of equipment should be provided, including 3 to 4 inches of feeder space per bird, one cup-type waterer per 100 birds, and, where necessary, 1½ square feet of shade per bird. The arrangement of the equipment will vary on different farms. The equipment should be spread out enough to make feed and water easily accessible, yet so placed that the birds can be fed and the waterers cleaned quickly and efficiently. For year-round breeding, inexpensive housing might well provide shade and protection, as well as flexibility in lighting, which is difficult to obtain without housing.

Nutritional factors in reproduction

Fertility needs. Accurate data regarding the effects of specific nutrients on fertility are limited with the exception of two vitamins.

It was reported some years ago that a deficiency of *vitamin A* caused male chickens to produce fewer sperm. In experiments with turkeys, fertility was reduced from 77 per cent to 50 per cent as birds became more deficient in vitamin A. Fertility increased again when the vitamin A in the ration was increased. Thus there is an indication that vitamin A may be a factor in maintaining fertility.

Work with chickens at Illinois over 20 years ago showed that *vitamin E* is necessary for fertility in males. After one year on a deficient diet (ferric chloride treated to destroy the vitamin E), males were still fertile; however, after two years, some males were sterile and there was some atrophy (shriveling) of the testes. More recent work at Kansas showed that males maintained on a ration of purified ingredients deficient in vitamin E for two months had testes of reduced size and showed degenerative changes of the seminiferous tubules. There was also less gonad-stimulating hormone in the pituitary. The levels of vitamin A and E necessary for good hatchability are also adequate for fertility.

Overweight. Observation has shown that fertility is low in excessively fat turkey hens or toms. Therefore, for birds to be used as breeders, special nonfattening rations are recommended after 20 weeks of age. The purpose of this ration is to limit energy intake without creating deficiencies of nutrients that are needed for hatchability. Work with chickens has shown that feeding low-energy rations causes an increase in feed consumption, but the increase is not in proportion to the decrease in energy. Body weight may not differ much, but chicks fed low-energy rations tend to have less fat and more water in their carcasses.

It is not good practice to limit energy intake simply by limiting total feed consumption unless the ration contains an adequate supply of nutrients other than energy.

The switch from grower to breeder ration should be made two to four weeks before egg production is expected. Once hens are in production, there is no longer danger of their becoming excessively fat.

Egg production. Nutrient factors of egg production are not usually considered by themselves, since most requirements are greater for hatchability than for production. An exception to this is the protein required for making the egg. It is presumed that the protein composition of the egg is constant and that once

the egg is formed, the protein is adequate for hatchability. The protein requirement for breeder hens is usually 15 to 16 per cent of the ration, but this amount can vary depending on the ration's energy content.

Hatchability. The vitamin and mineral content of the egg varies with the amount provided in the ration. Since eggs must contain certain amounts of these nutrients in order for the embryos to develop and hatch, the breeder ration should contain adequate amounts of the materials listed below. Hatchability studies have indicated that other nutrients may be important for turkeys, since purified rations have not been highly successful.

A deficiency of *vitamin A* causes a reduction in both egg production and hatchability. Kidney, skeletal, and eye abnormalities are noted in deficient embryos. The requirement is considerably higher than that for chicken breeders.

Vitamin D is needed at about twice the level required for chicken breeders, but it is easy to supply with present supplements.

Vitamin E has also been shown to be needed for hatchability. An eye disorder has been observed in poults from deficient hens and has been shown to occur late in the season with the feeding of poor-quality alfalfa. Antioxidants are helpful in preventing the destruction of vitamin E.

About 1.5 milligrams of *riboflavin* is needed per pound of feed.

About 7.5 milligrams of *pantothenic acid* is needed per pound of feed. Alfalfa meal and synthetic pantothenic acid are usually necessary to supply the requirement.

About 0.35 milligrams of *folic acid* is needed per pound of feed. This does not become a problem unless extremely low levels of alfalfa meal and soybean oil meal are used.

Other nutritional items. *Niacin* has not been shown to be necessary for hatchability. Apparently synthesis by the hen and embryo is adequate. *Choline* is synthesized by the hen, and an extra dietary source above that found in usual feedstuffs is not necessary. *Vitamin* B_{12} has been shown to be unnecessary for hatchability, although poults from deficient hens respond to B_{12} feeding.

Detrimental materials. Certain minerals have been shown to reduce hatchability in chickens and could presumably have the same effect on turkeys, although they have not yet been a problem in California. Certain samples of cottonseed meal at high levels are known to depress hatchability in chickens. In a study with turkeys, however, cottonseed meal caused no depression, although egg quality was affected. Egg-tested cottonseed meal can probably be used safely in turkey breeder rations.

Diseases that affect reproduction

Diseases affecting fertility and hatchability of eggs will be discussed under two headings: (1) diseases that are egg-transmitted and affect turkey production; and (2) diseases that are not egg-transmitted but affect the ability of the birds to be good breeders.

Egg-transmitted diseases. These diseases affect production in that when one of them is present in the hen, mortality of embryos or young birds can be high. The three major egg-transmitted diseases are as follows.

Pullorum disease is often transmitted from infected breeders through the egg to the poult. The organism can be present in other animals, however, and infection can take place by contact on the ranch. The disease is caused by a germ known as *Salmonella pullorum*. Poults may die from an egg-transmitted infection between three days and four weeks of age. Diagnosis of pullorum diseases is made at a laboratory by bacteriological culture of *Salmonella pullorum*. However, in order to control the

cycle of infection through egg transmission, recovered poults should never be used for breeders. The practical control of the disease is through testing and elimination of reactor birds and flocks. Pullorum disease in turkeys has been largely controlled in this manner, especially in the West.

Paratyphoid and Paracolon infections can also be egg-transmitted. Since deaths from these infections occur rather late in the course of embryonic development, late embryo mortality should be the first indication that the diseases may be present. Egg-transmitted mortality occurs at essentially the same time as it does with pullorum disease (although there may also be later peaks of death), and generally the same drugs provide effective control. These diseases are readily transmitted from other hosts, such as chickens, rodents, snakes, wild birds, or man. As with pullorum disease, infected flocks should not be used as breeders. In California, there is a flock-testing program for *Salmonella typhimurium*, one type of paratyphoid. Since this program has been used, the incidence of *Salmonella typhimurium* infection in poults has been lowered about tenfold.

Infectious sinusitis is caused by a germ known as a pleuro-pneumonia-like organism (PPLO). In turkeys this disease affects both fertility and hatchability. In egg-transmitted PPLO (or air-sac infection of turkeys) late embryonic mortalities occur, and air-sac lesions are found in the dead embryos. Control of the transmission of this disease seems to be in hatching poults from sinusitis-free flocks. Such a program has worked very satisfactorily, although it is quite costly if sinusitis occurs late in the bird's life.

The transmission of PPLO through the egg varies from hatch to hatch. However, if birds showing active disease signs are removed, the transmission rate is greatly reduced. By disposing of flocks with actively infected birds and combining this practice with an agglutination-testing program, we may eventually control egg-transmitted sinusitis. However, it must be pointed out that this control program is still in the experimental stages.

Antibiotics and other drugs may be effective against the sinus form of this disease. However, the air-sac form of the infection does not seem to respond to the antibiotics.

Non-egg-transmitted diseases. The diseases described below affect adult birds and, in one way or another, can damage breeding capacity.

Erysipelas, one of the most common diseases among toms during the breeding season in California, is caused by a germ known as *Erysipelothrix rhusiopathiae*. This organism is widespread in nature, and it can cause disease in sheep and pigs. Erysipelas should not be a problem to the breeder if he vaccinates twice before the breeding season with a bacterin. If the breeder fails to vaccinate the toms (hens are vaccinated only if the disease has occurred in this sex in previous years), disease may strike the toms, which seem to be most often infected, and they may become thin and very poor breeders. If infection occurs, a penicillin dose of 100,000 units per breeding tom is recommended. The drug must be given intramuscularly to attain high levels in the blood. Occasionally we encounter an erysipelas germ that does not respond to penicillin treatment. In such cases 250 milligrams of streptomycin is added to the inoculum.

Two cautions regarding turkey erysipelas should be kept in mind. One is that the artificial inseminator should avoid using toms that show evidence of disease of any kind. The handling of erysipelas-infected toms is not only dangerous to the handler himself, but it also provides a possible means of transmitting the infection via the semen to hens. Widespread infection has been observed in flocks of hens after insemination with semen from infected toms. If any evi-

dence of disease has been noted on a breeding farm, all insemination instruments must be boiled for 15 minutes before they are used again.

The second point is that erysipelas may affect the breeding ability of the toms whether they become obviously sick or not. Recently, a number of toms that had been vaccinated once were affected with erysipelas and only one bird died. A few weeks after the outbreak, 30 per cent of the toms that had previously given satisfactory volumes of semen were producing little or none. It is recommended that breeding toms be vaccinated with an erysipelas bacterin one month before an expected outbreak (estimated from the times of outbreaks in previous years in that locality) and again one month after the birds have come into sexual maturity.

Fowl cholera has somewhat the same effect on the breeder birds as erysipelas, although the male seems to recover more fully from a cholera outbreak. However, he will not be as good a breeder as he was before. There are at present no satisfactory vaccines for this condition, and the breeder must rely upon an accurate early diagnosis and treatment with the sulfa drugs. Penicillin in this case is not the drug of choice. Sulfa quinoxiline or sulfa methazine are excellent medicants in a cholera outbreak. Streptomycin injections (25 milligrams per pound of body weight) may be used on the obviously sick individuals. An accurate laboratory diagnosis must be made before a treatment is selected.

Fowl pox is a virus disease that seriously affects the breeder birds and can cause loss of production. Its control also depends upon proper vaccination to prevent infection. Breeder birds should receive two vaccinations at times recommended for the area. If good vaccination procedures are followed, fowl pox should not be a problem.

Another important infection, which produces serious damage to the breeding hen, is **Newcastle disease.** Although there may be no apparent symptoms in infected birds, the hens may lay soft-shelled eggs and a marked drop in production will be observed. Here again, an adequate vaccination program known to be satisfactory in the area should be followed. If the birds are immunized with wing-web vaccine, they will usually be adequately protected through the breeding season. Birds should be vaccinated not later than six weeks before the laying season starts.

Another disease, the so-called **blue comb,** or transmissible enteritis, is a nonspecific entity; its cause has not yet been determined. It, too, can cause a serious drop in egg production. The most important point in controlling the condition is to treat the birds as quickly as possible after the discovery of symptoms. Treatments of choice include very high levels of antibiotics in the feed. Antibiotics should also be administered in the drinking water. Birds that are badly affected should be hand-medicated with antibiotics in mineral oil. The effect on production is due mainly to the hens' tremendous loss of condition. No vaccines or other procedures for control have been developed.

Handling and Candling Incubated Eggs

Before incubation the following precautions should be observed:

1. Collect eggs frequently, especially in hot weather.
2. Store eggs for setting in a cool room, preferably 55–60° F, never below 40° or above 70°.
3. Do not set old eggs. Best hatching results are obtained with eggs no older than 7 days.
4. Do not set dirty eggs. Clean slightly dirty eggs with abrasive before storing.
5. Do not permit the eggs to sweat.
6. Do not set very large or very small eggs, or eggs with abnormal shells.
7. Check the accuracy of wet- and dry-bulb incubator thermometers between hatches.

During incubation make sure that operating conditions are satisfactory. In addition, discourage hatchery visitors and provide clean laboratory coats and rubbers for poult sexers and any other necessary transient personnel. Insist that chicken sexers use sterile equipment. Provide pans of disinfectant solution, and require anyone entering the hatchery to walk through them. Provide a separate washroom or outside washing area for equipment.

Temperature. Follow the procedure recommended by the incubator manufacturer. In general, most modern forced-draft machines are operated at 99.5° F from setting until transfer, and at 98.5° F during the hatching period.

Humidity. A number of different humidity schedules are being recommended by different companies and various research institutions. One that has given excellent results is included as an example:

Days	*Wet bulb*
0–3	88–90°
4–15	86°
16–21	85°
22–24	84°
25	80°
26	88°
27–28	90–92°

Air intake is opened 6 hours before hatch is taken off on the 29th day (or after 28 full days of incubation).

Turning. Both the frequency and angle of turning are important. An incubator that will turn eggs at least six times a day at angles at least 45 degrees from vertical is recommended. Eggs should not be turned after the 24th day.

Sanitation. Thoroughly clean and disinfect incubators and hatchers before each use. Eggs may be fumigated before incubation or during the first 24 hours. For machine fumigation use 35 cc of 40 per cent formalin and 17.5 grams of potassium permanganate per 100 cubic feet of machine space. Use double-strength fumigation after the eggs are transferred to the hatcher but before pipping begins if diseases such as omphalitis, salmonellosis, or respiratory infection are present in the flock.

Testing program

In order to diagnose the cause or causes of a reproductive failure, all aspects of the fertility complex must be considered. No one is more important than another. The testing program outlined on the following pages provides a method for early detection and diagnosis of a reproductive failure. The routine offers these advantages:

1. Early and more accurate diagnosis of the cause of a reproductive failure.

2. Detection of seasonal trends in fertility and hatchability.

3. Assistance in detecting a disease outbreak when it first occurs.

4. Means of distinguishing between infertility problems and egg-holding or -handling problems.

5. Detection of genetic lethals present in the breeding stock.

6. Detection of nutritional deficiencies in the breeder diet.

7. Estimation of the number of poults expected from a hatch by the end of the first week of incubation, and consequent aid in coordinating poult orders with numbers hatched.

AN EGG-TESTING PROGRAM TO DETERMINE THE CAUSE OF REPRODUCTIVE FAILURE

1. First candling test and breakout on 7th or 8th day.

In this operation a number of "clears" and blood rings will be detected by candling. Expect no more than 16 per cent removal. Five or 6 per cent will be early dead germs and the balance true infertiles.

The clears consist of a combination of true infertiles, fertiles that have died before laying (pre-ovipositol mortality), fertiles that have died during the holding period, and abortive types that have died in the first few hours of incubation (first-day deaths). These may be distinguished accurately only by examination of the blastodiscs.

If the number of clears is especially large, it is important to determine accurately whether infertility or early mortality of one of the above-mentioned types is predominant. This information may point to the cause of the trouble as follows:

If you find:	*The cause may be:*
High incidence of true infertiles.	Too few or too many toms Immature toms Too old toms and/or hens Such diseases as fowl pox, erysipelas (usually in the toms), or Newcastle disease Preferential or incomplete mating Seasonal decline in fertility in late spring and early summer Improper artificial insemination techniques
Deaths before eggs are laid (preovipositol deaths)	Stale semen resulting from insufficient frequency of mating or insemination Birds in poor condition from chronic disease
Deaths during holding period (before setting)	Eggs held too long before incubating Chilling (eggs held at too low temperatures) Birds in poor condition from disease or borderline nutritional deficiencies Stale semen

Deaths during the first few hours in the incubator. High incidence of abortive types dying during first few hours of incubation. These show only an irregular cellular development; no blood is present, and no embryo is visible	Eggs held too long Chilling Stale semen Birds in poor condition Eggs not gathered often enough in hot weather Inbred strains or strains carrying certain genetic abnormalities
Abnormally high incidence of blood rings. The 3rd and 4th days of incubation present a peak of embryonic mortality. Weak embryos and those with structural defects usually die during this period; thus, some mortality is always expected at this time. The amount of mortality by 7 days allows a reliable estimate of the total expected in the entire period, barring mechanical failures affecting only the terminal period. Approximately 45 per cent of the total embryonic mortality occurs by the 7th day, and 55 per cent in the rest of the incubation period	Eggs not gathered often enough in hot weather Eggs held at too high temperature (over 80° F) Incubation temperature too high or fluctuating widely during the first few days
High incidence of blood rings with embryos stuck to the shell membrane	Eggs not turned frequently enough or turned incorrectly

2. Second candling test and breakout on approximately the 24th day of incubation.

If you find:	*The cause may be:*
An abnormally large number of dead embryos (If the first candling has been well done, very few eggs should be removed at this time. Almost any number removed is cause for concern, since this period—8 to 24 days—is one of exceptionally low embryo mortality under normal conditions. Dead embryos should be examined closely and any symptoms shared by several should be recorded.)	Improper incubation temperature Inadequate turning Such diseases as infectious sinusitis, parathyphoid, pullorum, and other salmonelloses Specific nutritional deficiencies (note embryos showing the same symptoms) Certain hereditary lethals (note embryos showing structural defects) Lack of oxygen. If mortality is significantly different in different trays, look for faulty ventilation patterns

3. Taking off the hatch. Make the following observations for an analysis of poult quality and mortality among unhatched eggs.

Observations	Analysis	
	Finding	***Cause***
Time hatching begins and when complete	Early hatch	High temperature
	Slow hatch	Old eggs
		Low temperature throughout incubation
		Inbred stocks
	Wide variation in hatching time	Old eggs and eggs of different ages
		Extreme variations in egg size
		Inbred stocks
	Reason for culling	***Cause***
Total number of poults hatched; number culled	Weak legs	Nutritional deficiency
	Abnormally short legs	Nutritional deficiency or genetic abnormality
	Curled toes	Nutritional deficiency or genetic abnormality
	Crooked toes	Genetic abnormality or faulty temperature
	Spraddlers	Smooth trays
	Malformations	Temperature too high
	Weak birds	Temperature too high and moisture too low
	Small birds	Small eggs; temperature too high and humidity too low
	Wet birds	Temperature too low or humidity too high in hatcher
Over-all condition of poults	Record general impression of size, conditions, extent of drying, etc., of the average poults. Note whether poults are uniform in these respects or whether there is considerable variation, for example, in size or extent of drying, and also whether trays from different sections of the hatcher show any variation.	
	Description	***Cause***
	Poults overly large	Humidity too high in hatcher
	Poults sticky	Temperature too high in hatcher and humidity too low when pipping started

Description	Cause
Poults small and thin	Humidity too low
Mushy poults	Omphalitis (mushy chick disease) or poor ventilation
Bad odor	Omphalitis
Dead after hatching	Omphalitis Crowding Lack of oxygen
Labored breathing	Fumigation at too high concentration Insufficient moisture Respiratory disease
Rough navels	Temperature too high Wide temperature variation
Poults on different trays show different condition	Mechanical faults in incubator or hatcher (e.g., exhausts plugged or insufficient air)

Unhatched eggs

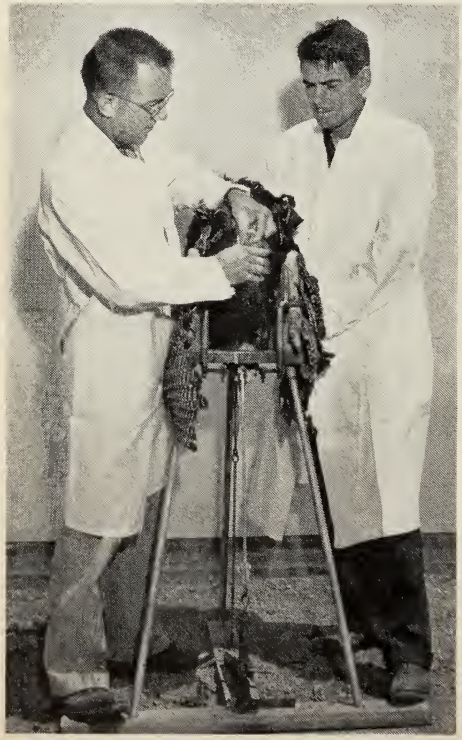
Results	Cause
Abnormally high number of pips (a good hatch should contain very few)	Temperature too low throughout incubation Humidity too low in hatcher Humidity too high in hatcher—poults drowned Insufficient oxygen in hatcher
Abnormally high number of non-pipped eggs left on hatching trays (This group includes those dying during the 2nd normal peak period of mortality. Normally one expects a certain incidence of malpositions, embryos that fail to achieve pulmonary respiration, deformed embryos, etc., to appear in this group. About 50 per cent of the total mortality is normally found at this time. Look for any condition repeated a number of times and record symptoms.)	Genetic lethals Nutritional deficiencies Certain diseases, Salmonella group especially Wide temperature variations during 2nd and 3rd weeks

Principles and Techniques Of Artificial Insemination

Artificial insemination is ordinarily practiced only when the flock presents an apparent fertility problem. Whenever artificial insemination is needed, a thorough analysis should be made to determine the cause of the fertility problem, and, where possible, appropriate measures should be taken to correct it.

Fertility problems can arise (as discussed earlier) from excessive inbreeding, from the presence of lethal genes in the flock, from various diseases, from nutritional deficiencies and other causes of poor vitality in the breeding stock, and from deficient mating frequency. Only the last of these may be expected to yield to artificial insemination. However, deficient mating frequency may itself be a consequence of one of the other causes, and thus the increased fertility from artificial insemination may be obtained only at the expense of a considerable increase in the number of dead embryos and/or poor-quality poults.

The principles of artificial insemination are simply to obtain viable sperm in good condition and to place them in the oviduct of the hen. The techniques involved, though also quite simple, require a certain knack and meticulous attention to details. These techniques and the equipment required are demonstrated in the following pictures and explained in the accompanying descriptions.



Stand for collecting semen.

Collecting semen

The tom is placed in a slightly forward-tilted position with his legs drawn downward or forward so as to expose the vent, and is restrained by an assistant.

By one method, the operator may hold the tom on his lap with the head between his legs or to his left, restraining the outer wing with his left elbow while the assistant grasps the legs firmly.

By a second method, the assistant may merely tip the tom forward (so that his crop rests on the ground) and bend his hocks, then pull the legs forward and restrain the wings at the same time with his arms.

By the third method (shown here), a stand with automatic leg-locks is used.*

* A construction diagram of this stand is available from the University of California Plan Service, Plan No. 70. A copy may be obtained by sending 50¢ to Agricultural Publications, Room 22 Giannini Hall, University of California, Berkeley 4, California.

The assistant merely restrains the wings and lifts the bird off the stand after collection is completed. In all the holding methods the operator should face the tom's left side.

In catching the tom, the assistant picks up the bird by the left wing and right leg. He must first secure a hold on the shoulder portion of the bird's left wing with his right hand, then immediately grasp the bird's right thigh with the left hand. These two actions should be completed rapidly, and the bird should be almost simultaneously lifted off the ground. This method of catching the toms minimizes struggling. When the holding table is used, the bird is placed on the apparatus without releasing or transferring the initial holds. The operator grasps the free left leg, and the legs thus placed into proper position are secured with the foot pedal of the leg-locking device.

The assistant holds both wings to prevent the bird's struggling during collection. After the semen is collected, the operator touches the foot pedal, which releases the leg-locks with trigger action. At this instant, the assistant draws the bird abruptly forward off the table. If this maneuver is properly done, the bird will have no time to struggle and can be placed on the ground without injury or undue effort.

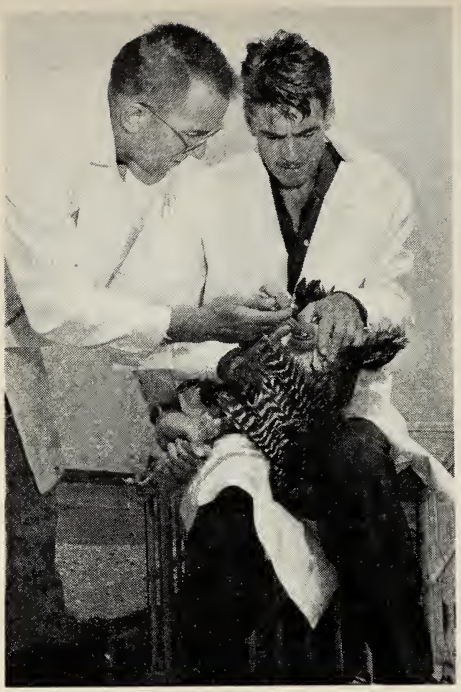
Semen-collecting operation

The operator places the palm of his left hand on the underside of the tail and pushes it quite firmly forward and down over the bird's back. This may in itself cause erection and protrusion of the phallus, especially in a bird from which collections have been made frequently, but additional stimulation is usually necessary and is advisable to produce maximal erection.

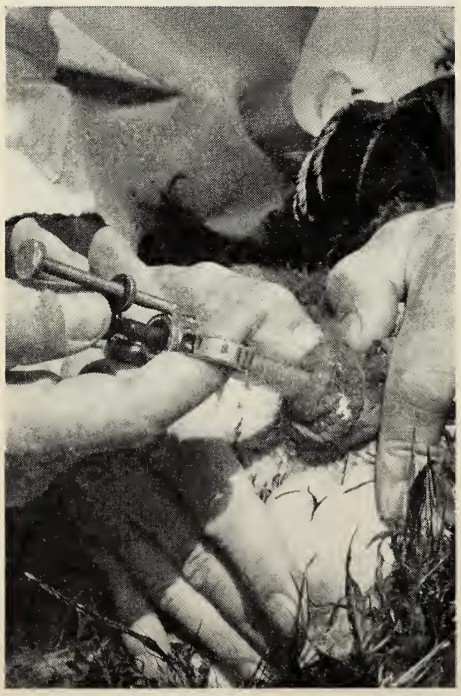
Stimulation is administered with the fingers and thumb of the right hand by stroking the abdomen along the undersides of the pubic bones. The amount of vigor and pressure to be used in stroking varies with the bird; with experience, the operator learns to gauge the desirable amount of stimulation by watching the tom's reaction. At the same time, the thumb and forefinger of the left hand may be used to stroke the sides of the vent. The thumb and forefinger should be moved together with each stroking movement, almost but not quite enough to compress the phallus. Stimulation is usually most effective when the stroking movements of the left and right hands alternate.

When maximal erection has been achieved, the stroking movements of the left hand are converted, smoothly and without pause, into a sustained pressure with thumb and forefinger on the sides of the *base* of the phallus in order to "milk" semen out of the bulbous ducts, as shown here. It is important here not to squeeze the phallus; the bulbous ducts lie

Close-up of the semen-collecting operation.



Method of holding bird during insemination.



Close-up of inseminating operation.

rather deep in the walls of the cloacal sphincter at the base of the phallus, and a considerable inward pressure is necessary to engage them.

As semen flows down the surface of the phallus, it may be collected in a small stem glass cup like the one shown at bottom of opposite page. During the preliminary stimulation and actual collection the glass cup is held with its base between the last two fingers of the right hand. The semen may also be collected in any convenient small glass receptacle or by suction into a vial held in a vacuum bottle (like the one shown on page 22) by a second assistant.

Inseminating

The semen is drawn into a suitable glass syringe (like the one shown on page 22), taking care to obtain a solid column of semen free of air bubbles. The usual dosage for turkeys is $\frac{1}{40}$ or $\frac{1}{30}$ milliliter, although some experimental work has suggested that smaller amounts may be adequate.

In inseminating, one man everts the oviduct and a second inserts the syringe into the everted organ. The first places the hen on his lap, with her head between his legs. The inseminator should also hold the hen's legs, especially if the bird shows any tendency to struggle.

As shown in the close-up picture, the everter places his left hand on the underside of the tail and firmly pushes it over the bird's back (much as was done with the tom). With the palm of his right hand, he applies gentle pressure to the abdomen and at the same time moves this hand down (that is, he exerts some stretch on the vent region). This action causes the cloaca to evert and the oviduct (and sometimes the anus) to protrude. Sometimes it is also helpful to pull gently on the edge of the cloaca with the thumb of the right hand. The oviduct is on the left side. The inseminator immediately inserts the syringe into the oviduct. For best results, it should be inserted as deep

as possible, but the insertion should not be forcible. Inserting the syringe with a wiggling or twisting motion often helps to pass the vaginal turnings.

Injection of semen

All pressure on the hen is released, and the inseminator continues to move the syringe forward in order to follow the oviduct inward as it is withdrawn. Only then should the semen be injected. Unless relaxation is complete before injection, the semen may be squeezed out of the oviduct by the pressure on the bird's abdomen. For the same reason, the hen should be set on the ground carefully; if she strains to get her balance, the semen may be ejected.

The hen may also be damaged if too much pressure is exerted on the abdomen while the oviduct is being everted. Internal organ injury is possible and, if extreme pressure is used, a fully formed egg in the uterus may be broken, with possible damage to the oviduct.

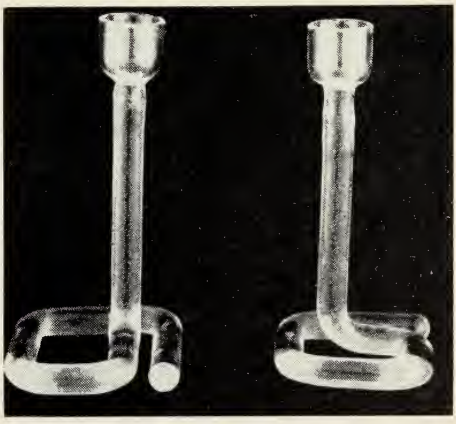
Injection of semen.

Semen cup

The cup holds about 1¼ milliliters and is made of a short piece of 15-millimeter (diameter) pyrex tubing fused to a stem of 7-millimeter (diameter) pyrex rod, which is bent to form the foot. The over-all height of this cup is 3 inches, but the length of stem may be varied to fit conveniently across a larger or smaller hand.

Aspirator bottle for collecting semen

Semen is picked up by the tip of the narrow glass tube, using gentle suction on the mouthpiece at the end of the rubber tubing. The semen is delivered into a glass vial that runs through a hole in the large rubber stopper. A vial attached on the side of the "Thermos" vacuum bottle is a trap to protect the mouth of the collector. A little warm water (about 75° F) in the bottle protects the semen from chilling. The water level should be below the bottom of the semen vial. Use of this equipment requires an additional man in the semen-collecting team.



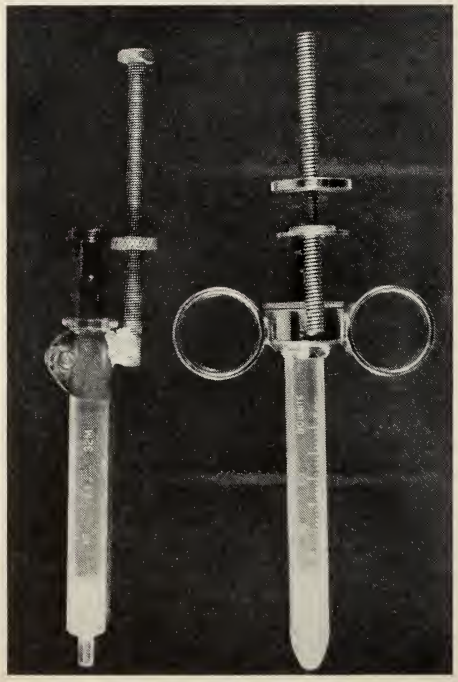
Semen cups.

Aspirator bottle.

Metered semen syringes

These are 2-milliliter long-type insulin syringes, each fitted with an external metering device. The syringe is filled in advance with enough semen so that the correct dose can be administered to several hens before refilling. The nut is turned down one full turn for each insemination. A $\frac{3}{16}$-inch screw, lathe-cut with 35 threads to the inch, delivers $\frac{1}{40}$ milliliter per turn; a standard No. 10 brass machine screw with 32 threads to the inch delivers $\frac{1}{36}$ milliliter. The screw should be brazed or soldered to a copper strap which is fastened to the syringe barrel with a small nut bolt. A thin sheet of rubber between strap and barrel will prevent slipping. The cap nut prevents accidental loss of the plunger (for example, when the syringe is inverted to remove air bubbles).

A commercially available model (B) is supplied with finger grips and a conical plastic tip to aid insertion and to guard against injury to the oviduct wall. The metering screw supplied with this model has 24 threads to the inch and delivers $\frac{1}{30}$ milliliter per turn.



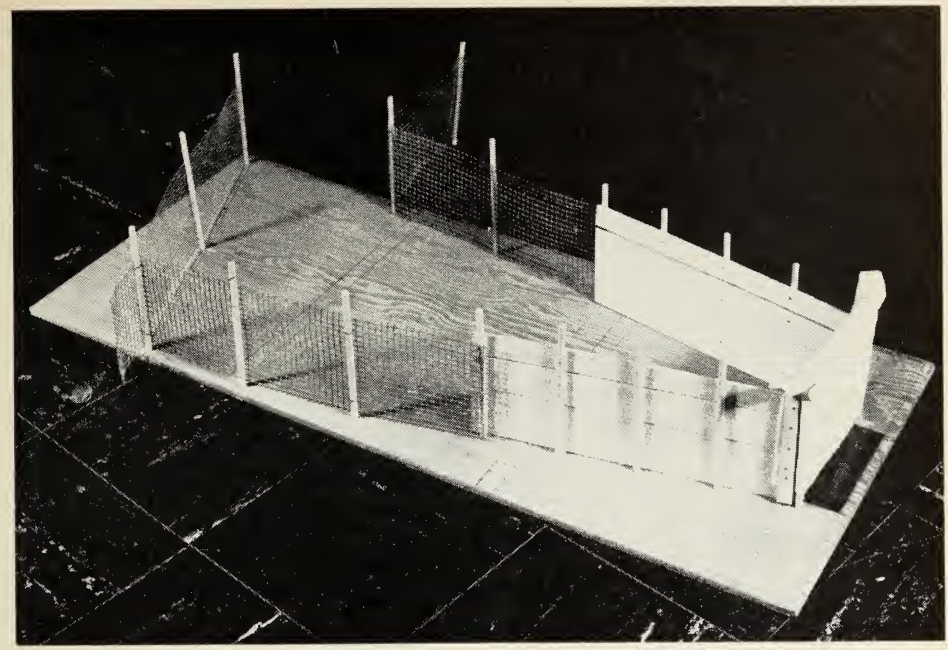
Metered syringes.

Field corral for handling turkey hens

The narrow end of this corral is about 5 feet wide and is covered with a canvas curtain which drops to within about 8 inches of the ground and is nailed to posts at the sides. A mat of rubber belting prevents the ground under the curtain from being excavated. The driver maneuvers the hens, a few at a time, against the curtain. The catcher then reaches through and picks them up, one at a time. The corral should be located under trees, or other shade should be provided to protect the hens from overheating while crowded in the enclosure. With such a corral, a seven-man inseminating crew, after some experience, can inseminate up to 1,100 hens per hour.

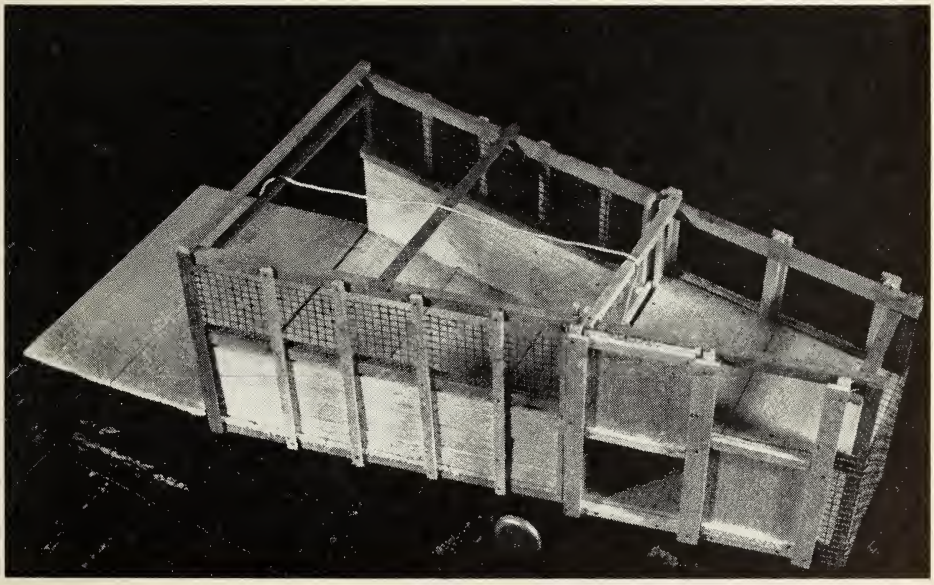
A portable turkey corral

This structure is especially useful where separation of flock units makes it more convenient to set up for insemination at several places rather than drive the hens to a single location. The corral should be about 20 feet long, 7 feet



Above, model of field corral for handling turkey hens.

Below, model of portable corral.



across at the wider end, and 2 feet across at the narrower. A few birds at a time are driven into the catching hatch; they enter readily if the end is equipped, as shown here, with wire netting. Two sliding drop doors permit two catchers to work at the same time, if desired. These doors should be equipped with counterbalance weights (not shown in the model) or a simple catch to hold them up while the operator reaches through for the hens. A cover of canvas or other light material should be stretched over the entire structure (including the hatch) to shade the birds in hot weather.

Tips for successful practice

Success in the practice of artificial insemination will be aided by attention to the following points:

1. Avoid dirt, especially feces, which may kill sperm rapidly. Great care should be taken to avoid collecting feces with the semen. Semen samples heavy with fecal material should be discarded. If fecal material is extruded on the surface of the phallus during stimulation, it may be wiped off with the thumb or a wad of cotton before the semen is squeezed out. Sometimes feces can be avoided only by skillful use of the collecting cup or aspirator tip. The opaque, white, solidified urine should also be avoided, but occasional small flecks apparently do little damage, as it is relatively insoluble.

2. Most toms do not require preliminary training to produce semen. However, a handling or two improves both the quantity and the cleanliness of the semen obtained, as the toms lose their nervousness and learn to coordinate their reflexes.

3. Semen quantity and cleanliness are also improved if the toms are picked up smoothly and in a manner that avoids struggling, and if stimulation is initiated without delay.

4. Semen cleanliness is improved if feed is removed several hours before the birds are handled. For obvious reasons, toms should not be driven into a new pen full of green grass. Water should also be removed an hour or two before collection of semen.

5. Collecting equipment and syringes should be rinsed during use with a 1 per cent solution of table salt. (A satisfactory salt solution may be made conveniently by dissolving one level teaspoon of salt in a pint of water.) The salt solution should not be allowed to dry on the equipment.

6. Semen should be used as soon as possible after collection, since the sperm lose their fertilizing capacity very quickly; best results may be expected when no more than a few minutes, or at most half an hour, elapse. Semen storage has been much studied recently, but most investigations have been made with chicken semen, and the results have not been widely enough verified to warrant present recommendations for field practice with turkey semen. These results have shown, however, that temperatures close to body temperature are very detrimental to semen before insemination; the optimum temperature is close to 50° F. but rapid chilling to this temperature is also detrimental. Chicken semen cooled slowly to this temperature has been held as long as four hours without reported reduction of fertilizing capacity. Moderate dilution with certain experimental diluents and similar precautions have permitted somewhat longer storage at slightly lower temperatures, but much additional investigation is necessary to work out completely satisfactory storage techniques.

7. Protection against cold may be necessary in frosty or cold, windy weather. Undiluted semen loses its fertilizing capacity as rapidly at temperatures close to 40° F as at body temperature; also, the detrimental effect of rapid cooling in experimentally stored semen suggests caution in permitting too rapid loss of temperature under any circumstances. When (as ordinarily) semen is to be used

at once, the only precaution probably necessary is slight warming of the collecting equipment and syringe in severe weather. If there is to be any necessary delay, provision should be made to cool the semen at about two degrees F per minute toward 50° F during the delay.

8. Maximum volume per sample is obtained when the toms are handled every two to seven days. If necessary, semen may be collected on two consecutive days without appreciable loss in volume, but if daily handling is continued, the volume drops. If they are mated, the toms should be separated from the hens two or three days before they are to be handled.

9. Experience has shown that $\frac{1}{40}$ milliliter of semen administered at three-week intervals maintains as high fertility until midseason as can be obtained by artificial insemination. Most egg producers prefer a two-week interval, although experimental evidence shows no advantage to this more frequent insemination. Late in the season, however, more frequent inseminations are desirable; for example, it may be necessary to inseminate on a weekly basis at this time.

10. A hard-shelled egg in the oviduct may interfere with insemination and reduce the duration of the resulting fertility. Thus, insemination is better done in the afternoon than the morning, but the difference may not be great, since turkeys lay eggs throughout the day. Insemination during the evening has recently been practiced with considerable success.

11. At midseason, the average tom should produce in excess of 0.2 milliliters, or at least enough for eight hens, at each handling. This figure is lower at both ends of the season.

12. There is some question whether anything is gained by allowing any natural mating at all during artificial insemination programs. If natural mating is prevented, treading damage to hens and the use of saddles are avoided. On the other hand, many flocks maintain as high fertility by natural mating alone as may be attained by artificial insemination.

13. Fertility may be low at the start of the season because of deficient mating before egg production begins (for example, as a result of inclement weather, delay in making up the mating pens, or immaturity of the toms). Deficient fertility from such a case is rarely improved, or at best is improved only very slowly, by subsequent natural mating because the hens are much less receptive to mating after the start of egg production. In such cases, one or two inseminations should quickly bring fertility to normal, and natural mating may then be able to maintain normal fertility.

14. If male immaturity is the problem, and the birds are in a closed flock, selection for early maturity may be practiced in succeeding years, using artificial collection of semen to estimate maturity before choosing the breeders.

15. If fertility drops in midseason (because of an unseasonable hot spell or for some similar reason), an insemination or two after the return of milder weather may bring fertility back to normal.

16. Artificial insemination of a diseased flock is usually useless. It is certainly undesirable, for it may spread the disease even more widely and the handling may damage the sick birds. However, if the disease is treated successfully, a series of inseminations after the birds have completely recovered may aid considerably in recovering the fertility lost during the disease.

17. To bring the males into maximum semen production, it may be desirable to train them by handling on alternate days for a period of a week or more before the first insemination date. To insure a maximal amount of semen, the toms should be removed from the hens two to three days before artificial insemination, and should be held in a pen reasonably close to the main flock of hens.

18. With large flocks, the hens in the separate field pens must usually be driven to the centrally located catching pen. Some hens will have to be removed from the trapnests. This removal should be gentle, since exciting the hens may cause damage, especially if they fly and strike the ground with any part of their body other than the feet.

Teamwork and Sanitation For Insemination Crews

Artificial insemination by crews of specialists who travel from ranch to ranch is a common current practice. Services of these crews, when available, are by appointment and for fees that are usually based on the number of hens inseminated. The crews use semen collected on the spot from the flock owner's toms. Ordinarily they are able to bring with them only the most portable equipment, so preparation on the part of the flock owner is necessary to permit them to work efficiently. (Some of the major aspects of preparation are illustrated and described in the preceding sections; other responsibilities of the flock owner are summarized below.)

The artificial insemination crew is divided into a collecting team and an inseminating team. The collecting team usually consists of two men—an operator who is skilled in collecting semen and a helper who picks up and restrains the toms. If a special device, such as an aspirator, is used to collect the semen, another man is needed. The number of men in the inseminating team is usually five but can be increased to seven. The personnel in the order they handle the hens are: the driver, the catcher, the holder, the "everter," and the inseminator. The driver maneuvers the hens to a position where they can easily be picked up by the catcher; the catcher transfers each hen to the holder, who places her in the lap of the "everter" but still restrains the hen by holding her legs; the "everter" then skillfully exposes the hen's oviduct for the inseminator. Upon completion of insemination, the hen is released gently, since frightening or mistreating her will have adverse effects upon egg production.

Sometimes, especially if the toms are producing well, insemination can be greatly speeded if the catcher supplies two holders and two everters; a single inseminator has no difficulty supplying semen for the extra everter. An alternate procedure, desirable especially if manpower is short, is as follows: the catcher places and restrains the hen on a suitable trough-shaped, padded platform; the inseminator then performs the eversion with his free hand, thus dispensing with the services of two men.

At present a few breeders have their breeding flocks confined in cages. The hens are inseminated at the cage door, as described above, and moderate speed in insemination is obtained with three men, the inseminator and two assistants.

As far as the size of the team is concerned, there are no strict rules to be observed in the practice of insemination. The number of men required depends upon the speed desired to inseminate a flock without sacrificing accuracy and without risking injury to the hens.

Teamwork is essential if artificial insemination is to progress smoothly and rapidly. The collecting team must obtain the semen and transfer it speedily to the inseminators. Three sources of difficulty in obtaining semen and dispensing it rapidly are: (1) inadequate catching facilities for the toms; (2) poor-producing toms; and (3) too great a distance between the two teams, making a messenger service necessary for transporting the semen.

Responsibilities of the breeding flock owner

The breeding flock owner should:

1. Provide the necessary facilities, such as corrals or yards to process the birds during the insemination period.

2. Provide additional men to complete the inseminating crew, since, in most cases, the visiting group brings in only such specialists as the semen collector, one or two everters, and the inseminator.

3. Separate the toms from the hens two or three days before insemination.

4. Remove feed about six hours, and water about two hours, before handling the toms (to lessen contamination of the semen with feces).

5. Be present during the operation, and, if possible, work with the crew at all times so that questions regarding proper treatment (or possible mistreatment) of the birds can be resolved on the spot.

Responsibilities of the visiting insemination team

The visiting artificial inseminating crew should:

1. Handle the toms and hens so that no damage occurs to them.

2. Practice sanitary measures to safeguard the health of the turkey flocks.

Vital sanitary precautions

An exacting sanitary routine must be followed in order to guard against spread of disease. Ideally, an insemination crew should visit only one farm in each day's operation. An inflexible requirement is to wear freshly laundered coveralls before entering each ranch. Rubber boots are also necessary. Boots, hands, and equipment must be scrubbed before and after each visit. If two ranches must be visited on the same day, a clean change of coveralls must be made.

Equipment may be cleaned with the so-called quaternary ammonium compounds. These products should never be used with soaps of any kind, because soaps will make these disinfectants useless. Before disinfecting any equipment, thoroughly remove all dirt. Two tablespoons of trisodium phosphate in the quaternary ammonium compound disinfectant solution will help in the cleaning process. Some crews prefer a 2 per cent lye solution, but this disinfectant is extremely caustic. If soap or detergent is used, it must be thoroughly rinsed off before disinfection. Empty syringes and semen-collecting apparatus should be washed and then sterilized in a pressure cooker at 15 pounds pressure for 20 minutes or soaked overnight in a good disinfectant. All cleaning compounds and disinfectants must be thoroughly rinsed off. The equipment should be dried, or else it should be rinsed with a 1 per cent salt solution immediately before use.

Avoiding diseased flocks

The presence of an active infectious disease in a flock creates a serious problem. Since handling sick hens may be injurious to them and may also promote a further spread of the disease, insemination at this time is undesirable and should be discouraged. Furthermore, a significant increase in fertility or hatchability is unlikely to be obtained by inseminating sick hens. If the owner is aware of an infectious disease condition, he should postpone insemination until the health of the turkeys has improved. If the crew members are aware of it, they should refuse to visit the premises.

Any information must be treated in confidence by the visiting inseminating crew, since the breeder's reputation may be at stake.

Crew members should also remember that they are not to make a diagnosis of disease. A diagnosis is the function of the diagnostic laboratories.

Discovery of evidence of active disease by crew members after they have begun to handle the birds poses an even more delicate problem. Should this occur, very careful and thorough sterilization of outer clothing, footwear, and equipment is necessary; in no such case should a second ranch be visited on the same day.

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